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OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER
OH, TAYLOR V

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/815,873
Filing Date: April 02, 2004
Appellant(s): MACHHAMMER ET AL.

Harris Pitlick
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 5/25/07 appealing from the Office action mailed 2/27/07.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying by name the real party in interest is contained in the brief.

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

A statement identifying by name the real party in interest is contained in the brief.

6,858,754	BORGMEIER et al	3-1984
EP 1193240	BOGAN et al	9-1992
WO 00/09260	KARIM et al	3-1999
JP07053448A	KOYASU et al	2-1993
3,766,286	G.A.OLAH	10-1973
4,220,802	AKIYAMA et al	9-1980

T.P.HILDITCH, Catalytic Process in Applied Chemistry, New York , D. Van Nostrand Com. 1929, p. xiii.

(9) Grounds of Rejection

The Status of Claims

Claims 1-32 are pending.

Claims 1-14 and 17-32 are rejected.

Claims 15-16 are objected due to the rejected claim.

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-14 and 17-32 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a titanium- containing silicon oxide as a solid state catalyst as shown in the following formula: $Mo_1V_bM^1_cM^2_d$ (I)

M^1 = Te and/or Sb,

M^2 = at least one of the elements from the group consisting of Nb, Ta, W, Ti, Al, Zr, Cs, Ca, Sr, Ba, Cr, Mn, Ga, Fe, Ru, Co, Rh, Ni, Pd, Pt, La, Bi, Pb, Cu, Re, Ir, Y, Pr, Nd, Tb, Ce, Sn, Zn, Si, Na, Li, K, Mg, Ag, Au and In,

b = from 0.01 to 1

c = from > 0 to 1 and

d = from > 0 to 1.

, this does not reasonably provide enablement for all kinds of catalysts known in the art. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to include all kinds of catalysts unrelated to the claimed invention commensurate in scope with these claims.

Furthermore, the instant specification fails to provide information that would allow the skilled artisan to practice the instant invention without **undue experimentation.** Attention is directed to *In re Wands*, 8 USPQ2d 1400 (CAFC 1988) at 1404 where the court set forth the eight factors to consider when assessing if a disclosure would have

required undue experimentation, citing *Ex Parte Forman*, 230 USPQ 546 (BdApls 1986) at 547 the court recited eight factors:

1) the quantity of experimentation necessary,

2) the amount of direction or guidance provided,

3) the presence or absence of working examples,

4) the nature of the invention,

5) the state of the prior art,

6) the relative skill of those in the art,

7) the predictability of the art, and

8) the breath of the claims.

The Nature of the Invention

The nature of the invention in claim 1 is the process for heterogeneously catalyzed partial oxidation of propane and /or isobutane to at least one of the target products acrylic acid, methacrylic acid, by passing over a solid state catalyst.

The State of the Prior Art

The states of the prior art are described as followed:

Borgmeier (US 6,858,754 B2) discloses a process for preparing acrylic acid by heterogeneously catalyzed partial oxidation of propane by a process in which the steam content of the reaction gas starting mixture is reduced in the process;

Bogan et al (EP 1193240 A1) discloses a method of producing unsaturated carboxylic acids by subjecting alkanes to vapor phase catalytic oxidation in the presence of $A_aM_mN_nX_xO_o$;

[0011] Japanese Laid-Open Patent Application No. 07 - 053448 discloses the preparation of acrylic acid by the gas-phase catalytic oxidation of propene in the presence of a mixed metal oxide catalyst of the formula

$$Mo_aV_bTe_cX_dO_n$$

wherein X is at least one element selected from Nb, Ta, W, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pd, Pt, Sb, Bi, B, In, Li, Na, K, Rb, Cs and Ce; a = 0.25 - 0.98; b = 0.003 - 0.5; c = 0.003 - 0.5; d = 0.003 - 0.5 and n is determined by the oxidation state of the other elements.

G. A. Olah (US 3,766,286) discloses 24 various super acid catalysts supported by antimony trifluoride, aluminum trifluoride, sulfonated cation exchange resins, etc. , which are employed for isomerizing paraffinic and /or alkyl substituted aromatic hydrocarbons.

[0012] Similarly, Published International Application No. WO 2000/09260 discloses a catalyst for the selective oxidation of propene to acrylic acid and acrolein which comprises a mixed metal oxide of molybdenum, vanadium, lanthanum, palladium niobium, and copper and/or chromium wherein the metals are present in the ratios given by the formula

$$Mo_aV_bLa_cPd_dNb_eX_f$$

wherein X = Cu and/or Cr; a = 1; b = 0.01 to 0.9; c = greater than zero to 0.22; d = 0.0000001 to 0.2; e = 0 to 0.2; and f= 0 to 0.2.

As the prior art have been discussed in the above, there is no conclusive data that all the kinds of solid catalyst in the process of heterogeneously catalyzed partial oxidation of propane and /or isobutane to at least one of the target products acrylic acid would be required to produce the final desired product except only certain combinations of solid catalyst useful in the partial oxidation process .

The predictability or lack thereof in the art

In the instant case, the instant claimed invention is highly unpredictable since one skilled in the art would recognize that not every solid catalyst would work on the claimed process in the same way as do certain combined catalysts such as a

$Mo_1V_bM^1_cM^2_d$ (I) disclosed in the specification.

According to T.P.Hilditch, the author of the "Catalytic Processes in Applied Chemistry" (see page Xiii, 1929), there is a definitive reason for an unpredictable aspect of the catalysts in the art of organic chemistry. T.P.Hilditch expressly teaches that any solid catalyst would not work for any kind of the reaction process; for example, the specific catalysts such as vanadium or molybdenum oxides can be used for the oxidation of hydrocarbons; on the other hand, this same kind of catalysts will not apply to the other types of the reaction process in the followings: the chlorine manufacture, the oxidation of fatty acids and nitric oxide, ammonia synthesis, ammonia oxidation , sulfuric acid manufacture, and etc. (see page Xiii).

Furthermore, the specification of the claimed invention does support the very idea of the unpredictable aspect of the catalysts by disclosing the following specific , workable catalyst for the oxidation (see pages 10-12), not all kinds of the solid catalyst known in the art will work.

Moreover, chemical reactions are well-known to be unpredictable, *In re Marzocchi*, 169 USPQ 367, *In re Fisher*, 166 USPQ 18. Additionally, catalytic processes, such as are present here, are inherently unpredictable. The U.S. District

Court District of Connecticut held in MOBIL *OIL CORPORATION v. W.R. GRACE & COMPANY*, 180 USPQ 418 that "there is an inherent mystery surrounding the unpredictability of the performance of catalysts; a mystery which is generally recognized and acknowledged by chemists in the cracking art. This is one more reason why the presumption of patent validity "should not be disregarded especially in a case of this sort where the intricate questions of [bio]chemistry involved are peculiarly within the particular competence of the experts of the Patent Office." *Merck & Co. v. Olin Mathieson Chemical Corp.*, 253 F.2d 156, 164, 116 USPQ 484, 490 (4th Cir. 1958)". "The catalytic action can not be forecast by its chemical composition, for such action is not understood and is not known except by actual test, *Corona Cord Tire Co. v. Dovan Chemical Corp.*, 276 U.S. 358, 368-369 (1928). Also see, *Application of Grant*, 304 F.2d 676, 679, 134 USPQ 248, 250-251 (CCPA 1962); *Rich Products Corp. v. Mitchell Foods, Inc.*, 357 F.2d 176, 181, 148 USPQ 522, 525-526 (2d Cir. 1966), cert. denied 385 U.S. 821, 151 USPQ 757 (1966); *Ling-Temco-Vought, Inc. v. Kollsman Instrument Corp.*, 372 F.2d 263, 268, 152 USPQ 446, 450-451 (2d Cir. 1967); *Georgia-Pacific Corp. v. United States Plywood Corp.*, 258 F.2d 124, 132-133, 118 USPQ 122, 128-129."

Therefore, from the above, it is clear that the use of every generic " solid state catalyst" will not form the desired claimed product in a good yield.

The amount of direction or guidance present

The direction present in the instant specification is that not any catalyst can be led to the formation of the desired product. According to the specification, it is silent as to how any solid catalyst can be led to the formation of the desired product and fails to provide guidance as to whether any solid catalyst is sufficient enough to allow to form the desired product in sufficient quantities; the specification fails to provide a correlation between the claimed process of the invention and the functional language of any solid catalyst .

The presence or absence of working examples

There is only 1 working example using the $Mo_1V_{0.29}Te_{0.13}Nb_{0.13}O_x$ catalyst composition for producing the desired compound in the specification. This can not be the representatives for all the catalysts which would work for the claimed process. Thus, the specification fails to provide enough working examples as to how the other types of catalysts can be resulted in the claimed products, i.e. again, there is no correlation between the functional language of any solid catalyst and the desired final product.

The breadth of the claims

The breadth of the claims is that any solid catalyst would work on the claimed process in the same way as the disclosed catalyst without considering the affect or impact of the different catalysts on the starting compound , thereby affecting the yield of the desired final product.

The quantity of experimentation needed

The quantity of experimentation needed is large. One of skill in the art would need to determine which one of the solid catalysts would be capable of forming the desired product and would furthermore then have to determine which one of the solid catalysts would not be resulted in the claimed desired compounds in a sufficient quantity.

The level of the skill in the art

Even though the level of skill in the art of the partial oxidation of propane and /or isobutane to produce at least one of the target products acrylic acid is high, the skilled artisan employing this process would be a BS Chemist working in a laboratory facility. He would know how to use the taught solid state catalyst, but not how to select other catalyst without trial and error.

Therefore, in view of the Wands factors and In re Fisher (CCPA 1970) discussed above, to practice the claimed invention herein, a person of skill in the art would have to engage in undue experimentation to test which solid catalyst can be employed to produce the desired claimed compound encompassed in the instant claims, with no assurance of success.

(10) Response to Argument

1. Applicants argue that the rejection of claims 1-32 under U.S.C. 103(a) as unpatentable over Ushikubo et al (U.S. 5,380,933) in view of Bogan et al (EP 1193240) is untenable and should not be sustained.

Applicants' argument has been noted, and the argument is persuasive. Therefore, the examiner has decided to withdraw the rejection of claims 1-32 under U.S.C. 103(a) unpatentable over Ushikubo et al (U.S. 5,380,933) in view of Bogan et al (EP 1193240).

2. Applicants argue that, since this invention is not limited to particular catalysts and the number of catalysts known for heterogeneously catalyzed partial direct oxidation of propane and /or isobutane to form (meth)acrylic acid is vast, the presently-claimed invention could be carried out with any such catalyst and one skilled in the art would be enabled to choose applicable catalysts by routine experimentation.

Applicants' argument has been noted, but the argument is not persuasive.

In order for the one skilled artisan in the art routinely to figure out or choose applicable acid catalysts beyond those listed in the specification, the artisan in the art needs a definitive guidance or direction from the specification. What has been offered from the specification as for the guidance is the use of the only one particular exemplified $Mo_1V_{0.29}Te_{0.13}Nb_{0.13}O_x$ catalyst composition for producing the desired compound in the specification. This can not be the representatives for all the catalysts which would

work for the claimed process. Thus, the specification fails to provide enough working examples as to how the other types of catalysts can be resulted in the claimed products, i.e. again, there is no correlation between the functional language of any solid catalyst and the desired final product.

The instant claimed invention is directed to " a solid state catalyst "; in other words, it means that any solid state catalyst will work for the oxidation process. To the minds of the skilled artisan in the art, the careful selection of the workable solid state catalyst for the oxidation of the hydrocarbon compound is very important because the yield of the desired product or the success of such an operation depends on it. It is highly unpredictable since one skilled in the art would recognize that not every solid catalyst would work on the claimed process in the same way as do certain combined catalysts such as a $Mo_1V_bM^1_cM^2_d$ (I) disclosed in the specification. For example, G. A. Olah (US 3,766,286) discloses 24 various super acid catalysts shown in the paragraph (col. 2, lines 30-71) supported by antimony trifluoride, aluminum trifluoride, sulfonated cation exchange resins, etc. (solid state catalyst)(see col. 3 ,lines 25-43), which are employed for isomerizing paraffinic and /or alkyl substituted aromatic hydrocarbons; this prior art process also requires inhibitors to suppress those catalysts which have a strong tendency to cleave the hydrogen ions from the hydrocarbons (see col. 4, lines 4-6). Thus, if those solid super acids disclosed in G. A. Olah (US 3,766,286) were applied to the claimed process, it would have been unpredictable and completely different from the claimed process. This is because those solid state super acids had a high likelihood of removing hydrogen ions from either of the claimed reactants,

propane and/or isobutane, instead of helping them to form the desired acrylic acid product, thereby detrimentally affecting the yield of the desired final product or the outcome of the oxidation process. Therefore, unlike applicants' argument, the skilled artisan in the art could not assume that any selection of "solid state catalyst" would work for the oxidation process.

Furthermore, another prior art Akiyama et al (US 4,220,802) describes a different aspect of the unpredictability of using the solid catalyst; it discloses the particular solid form of the catalyst: $Mo_aP_bV_cL_dM_eO_f$ applicable for the process of producing acrylic acid by reacting acrolein with oxygen; Akiyama et al further points out that some solid Mo-V type catalysts are well-known to have such drawbacks as a poor reproducibility and a great fluctuation in catalytic activity with the passage of time (see col. 1, lines 39-43) during the oxidation process, while the other Mo-V type catalysts can show a remarkable result. From this evidence, it becomes clear that a great productivity of the desired product in commercial operations can not be guaranteed due to the unpredictability of using such solid catalysts during the oxidation process; thus, the meticulous selection of the suitable "solid state catalyst" would be a key for the successful oxidation process.

Finally, T.P.Hilditch, the author of the "Catalytic Processes in Applied Chemistry" (see pages Xiii-XV, 1929) has demonstrated that there is a definitive reason for an unpredictable aspect of the catalysts in the art of organic chemistry. T.P.Hilditch expressly teaches that any solid catalyst would not work for any kind of the reaction process; for example, the specific catalysts such as vanadium or molybdenum oxides

can be used for the oxidation of hydrocarbons; on the other hand, this same kind of catalysts will not apply to the other types of the reaction process in the followings: the chlorine manufacture, the oxidation of fatty acids and nitric oxide, ammonia synthesis, ammonia oxidation , sulfuric acid manufacture, and etc. (see page Xiii).

Therefore, unlike applicants' argument, the right choice of the solid catalyst is essential in the oxidation process. Thus, applicants' argument is not persuasive.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Taylor Victor Oh
Primary Examiner
Art Unit 1625

8/30/07

Conferees:

8/31/07

Shaojia Jiang, Ph.D.
Supervisor
Art Unit 1623

JANET L. ANDRES
SUPERVISORY PATENT EXAMINER

Janet Andres, Ph.D.
Supervisor
Art Unit 1625

OBLON, SPIVAK,MCCLELLAND, MAIER & NEUSTADT,P.C.

1940 DUKE STREET

ALEXANDRIA, VA 22314